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ABSTRACT

This study investigated the attention or arousal of above and below average boys and girls while viewing a science television program on videotape. Skin resistance (GSR) was measured by a biosensor attached to a microcomputer and served as the dependent variable. Analysis of the data included a 2x2x8 ANOVA of gender v. ability v. GSR. The significant three-way interaction indicates that low-ability girls had the lowest GSR measures and inferentially that they were the least attentive to the videotape. High ability boys and girls, and low ability boys produced equal GSR measures. These results suggest that a low cost GSR biosensor may be useful to science education researchers with an additional measure of attention or arousal. (Author/CW)

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Gender and Ability Attentional Differences While Watching an Educational Television Program

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RUNNING HEAD: TELEVISION ATTENTIONAL DIFFERENCES . . .

Gender and Ability Attentional Differences While Watching an Educational Television Program

ABSTRACT

This study investigated the attention or arousal of above and below average boys and girls while viewing a science television program on videotape. Skin resistance (GSR) was measured by a biosensor attached to a microcomputer and served as the dependent variable. This two-between-one-within ANOVA included: 2 (gender: male or female) x 2 (ability: above or below the median) x 8 (time: GSR measurements at 3-minute intervals for 21-minutes). The significant three-way interaction indicates that low ability girls had the lowest GSR measures and inferentially that they were least attentive to or aroused by the videotape. High ability girls, high ability boys, and low ability boys produced equal GSR measures. These results suggest that a low cost GSR biosensor like the one used in this study may provide science eductaion researchers with an additional measure of attention or arousal.

Gender and Ability Attentional Differences While Watching an Educational Television Program

This study considers the use of galvanic skin response (GSR) as a measure of arousal, attention, or affect during television viewing (Prokasy and Raskin, 1973). The assumption is that GSR measurements of students taken during media use correlate well with many variables of interest to science education researchers. The implication is that GSR measures may provide information not readily available through other means.

Usually, devices for measuring GSR are fairly expensive and typically obtrusive. This study used a low cost, easy to use, but less sensitive handheld biosensor about the size of a deck of cards that measures skin resistance. Students can hold the device comfortably while engaged in other activities. This biosensor and software are available for $99 retail (Sunburst, 1986) and may prove to be a useful research tool.

Physiologic Measures and TV Research

In a recent article (Reeves, Lang, Thorson, and Michael, 1989) on the effects of television scenes on cortical arousal, a physiological variable (EEG) varied systematically with the emotionality of television scenes. The authors pointed out the need to investigate physiological differences for one person within a single media presentation rather than between media. Also, they noted that television should not be viewed as a psychological stimulus of a certain type. Rather, television's ability to present lifelike situations suggests that viewers' physiological response to scenes relates to their real life response to the same situations.

GSR (also termed electrodermal response of Fere, EDR(F), and skin resistance response, SRR) is generally considered to be a measure of autonomic arousal, as pointed out by Reeves et al. (1989), but it is also considered to be a measure of attention (Raskin, 1973). Correlations

between GSR and attitude, empathy, and social interaction especially in small groups have been shown (Schwartz and Shapiro; 1973). In an early study which involved GSR and film, Ruckmick in 1933 revealed GSR differences for comedic, conflictual, and romantic film segments for viewers of different ages (Schwartz and Shapiro, 1973). Very high correlations between GSR and self-report led Lacey (1959) to state that "... the differential magnitude of galvanometric deflections to words is one of the most reliable phenomena in psychology today!" (p. 201). GSR measures correlate well with measures that are of interest to science education researchers.

Salomon (1979, 1982) has suggested that students' attention or response to media depends upon their perception of the difficulty of that media. Television in the United States is generally considered to be an "easy" medium (Salomon, 1984). High-ability and low-ability learners appear to view media differently, so ability by media type interactions are probable (Salomon, 1979; Salomon and Leigh, 1984).

The content presented by various media forms may also affect students' perception of that particular combination of media and content. For example, girls and boys often differ in their reactions to science topics. Generally, boys prefer science more than girls (Esquivel & Brenes, 1988; Tamir, 1988; Tobin & Garnett, 1987). Therefore, high ability students and boys would tend to prefer an educational science program on television compared to low ability students and girls.

This study investigated the questions: 1) Is there a difference between GSR measures for high versus low ability students while watching a science television program? and 2) Is there a difference between girls and boys GSR measures while watching this same program? A two between, one within subjects design was used to test viewers' GSR response to an educational television program. The factors in this study were gender (male and female), ability (low and high) and time (8 measures at 3-minute periods during the 21-minute viewing period). The dependent measure was GSR skin resistance values provided by the biosensor.

METHOD

From two fifth and sixth grade classes of a local parochial elementary school, a sample of 20 boys and 20 girls was randomly selected for inclusion in this study. Subjects (Ss) were predominantly white from middle-class families. This school routinely uses various media devices like slide projectors, VHS videos, overhead projectors, and microcomputers. All of the Ss were familiar with the Panasonic VHS player and the handheld GSR biosensor used in this study. Ss were classified by ability based upon results of the Reading subtest of the Iowa Test of Basic Skills which was given at the beginning of the school year.

A 21-minute educational television program "Mr. Wizard" starring Don Herbert was used in this study. This video was selected based upon its educational nature, its age level relevance, its quality of production, and its availability. The program contained nine topical sections which are labeled below as segments A through I in table 1. Segments of the program included either male or female actors of about the same age as the Ss. Each program segment lasted about three minutes and was fairly self-contained. Each segment had associated music which helped define set and closure of the segment. Each segment explained a specific idea or science concept through a participatory demonstration.

INSERT TABLE 1 ABOUT HERE

The purpose and procedures of the study were described to the Ss who were then allowed to volunteer or be excused from the study. The classroom teachers were informed of the study but were intentionally not involved in the study. All Ss participated. A Panasonic VHS personal viewer with headphones was set up in the computer laboratory of the school. One at a time, students came to the lab to view

the video. The lab manager, who was well known to the Ss, helped the Ss with the biosensor and the video-player, and also recorded the GSR data. The GSR biosensor (Sunburst,1986) was attached to an Apple IIe computer placed near the video-player. The biosensor was held in the Ss non-dominant hand and was fairly unobtrusive. The computer monitor was placed so that Ss were unable to see their GSR output. GSR measures were recorded at three minute intervals. The computer lab was maintained at a constant temperature between 70 and 72 degrees, and room lighting was high quality indirect fluorescent designed especially for the lab in order to reduce screen glare. All readings were taken in the morning over the course of one week in order to reduce possible diurnal or circadian confounding variables.

RESULTS

Statistical computations were carried out using the microcomputer statistics program "ANOVA Statistics" developed by Dr. Andrew Bush for analyzing repeated measure designs. This two between-one within design compared three main effects: 2 gender (male-female) by 2 ability (low-high) by 8 time (GSR measures every three minutes). Neither gender nor ability main effects were shown to be significant. The main effect for time was significant with an $F_{(7,245)} = 2.317$, $p=0.03$ revealing a general increase in GSR measures across the 21-minute viewing session. None of the two-way interactions was shown to be significant. The three-way interaction was significant with an $F_{(7,245)} = 1.931$, $p=0.06$ (*a priori* alpha = 0.10 due to the exploratory nature of the study).

INSERT FIGURE 1 ABOUT HERE

A graph of this interaction (figure 1), shows that all four groups had comparable GSR measures initially (time 0), but by the third

minute of the video lesson, an obvious difference for low ability females is observed. At the sixth minute, there was a general increase in the high ability females and a slight decrease for both low and high ability males. The video segment at this point showed a boy talking with a robot. Whether the high ability girls GSR increase is due to the content, the actor, or random variance is uncertain. At the ninth minute, the video shows a girl working with temperature sensitive film. The low and high ability boys GSR increased and the high ability girls GSR decreased. At about the twelfth minute, three commercials were presented. The low and high ability females and the high ability males GSR increased, while the low ability males GSR decreased. Interestingly, the only GSR increase for the low ability girls occurred during the commercial. GSR decreased slightly for all groups after the commercial. From about the eighteenth minute to the end, GSR tended to increase, perhaps due to more lively music in the audio portion of the video.

DISCUSSION

The results confirm that gender and ability differences in GSR occur for 5th and 6th graders while watching a science educational television program. For this specific science content presented by television, no GSR differences by ability or gender alone occurred, however the interaction of ability and gender did produce GSR differences. Specifically, the low ability girls were less attentive or aroused than the low ability boys, high ability boys, and high ability girls. An interaction of ability, gender, medium, and content probably occurred in this study.

Alternately, studies have shown that boys prefer to work alone while girls prefer not to work alone (Allen, 1987; Tobin & Garnett, 1987). In all cases in the present study, Ss viewed the video-tape alone. Therefore, the methodology used may have confounded the results of this study. The boys' high GSR measures may be a result of viewing alone rather than of any preference for science or television. Additional research on this question is recommended.

Biosensors of this type are now available that are low in cost and simple to use. The literature cited suggests that GSR differences occur during interpersonal and small group interactions, and correlate with self-reports of attitude or effort. Practically, GSR measures of attention may be utilized for matching instructional content and methods to students prescriptively. For example, in this study the low ability girls showed the lowest GSR for this science TV program. Perhaps another presentation form such as group viewing of the same lesson would be better for the low ability girls.

Science teachers should be particularly interested in GSR. First, students are usually very interested when collecting and analyzing "self-data". Students can investigate the effects of various cognitive activities like listening to music, watching films, and others that they decide upon on their own GSR (Clariana, 1989). Discovery activities of this type promote higher level thinking. Second, teachers may use GSR as a dependent variable in their own research projects.

GSR is a covert measure that is instantly available. An interactive learning system driven by an expert system or artificial intelligence may utilize GSR data prescriptively. Additional research with GSR is required to approach this goal.

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Table 1. Descriptions of Video Segments

A - Boy using a water gun to produce a fire
B - Girl boiling water in a bottle
C - Narration and images of a snowflake
D - Boy with a talking robot
E - Girl with a temperature sensitive hand print
F - Commercials for cereal, then dolls. then match-box cars
G - Narration about locusts on the Mississippi River
H - Girl with spool and rubber-band car
I - Girl with salt versus sugar fruit drink
end - closing credits

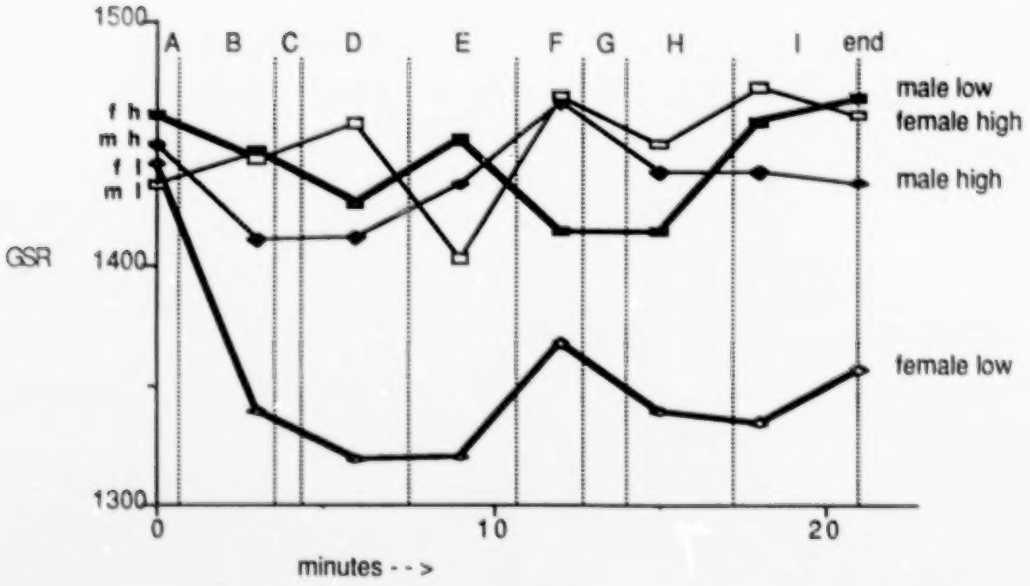

Fig. 1. Mean GSR responses across time grouped by gender and ability. The letters A through I correspond to the different segments of the video. A description of each video segment is included in Table 1.

Supplementary Table. Analysis of Variance Table

source	SS	DF	MS	F.ratio	p.alpha
A-Gender	87968.273	1	87968.273	0.405	0.54
B-Ability	181641.094	1	181641.094	0.837	0.37
A x B	200432.359	1	200432.359	0.923	0.35
S/ A x B	7599223.500	35	217120.672		
C-Time	68049.859	7	9721.408	2.317	0.03 *
C x A	47490.332	7	6784.333	1.617	0.13
C x B	25331.039	7	3618.720	0.863	0.54
C x A x B	56717.148	7	8102.450	1.931	0.06 *
C x S / A x B	1027800.250	245	4195.103		
TOTAL	9294654.000	311			